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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/886,511	06/21/2001	Karen L. Coates	99-315A	6891

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EXAMINER
MCDONALD, RODNEY GLENN

ART UNIT	PAPER NUMBER
1753	3

DATE MAILED: 10/16/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

206-655-5076
Conrad Gardner

MK-3

Office Action Summary

Application No.	Applicant(s)
09/886,511	Coates et al.
Examiner	**Art Unit**
Rodney McDonald	1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on Jun 21, 2001 .

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) 8-10 is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) 8-10 is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
4) ☐ Interview Summary (PTO-413) Paper No(s). _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. Claims 8-10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 8 is indefinite because it is dependent on a canceled claim.

Claim 8 is indefinite because the phrase "such as" renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP. § 2173.05(d).

Claim 9 is indefinite because it is dependent on a canceled claim.

Claim 9 is indefinite because the phrase "such as" renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP. § 2173.05(d).

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was

commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aviram et al. (U.S. Pat. 4,491,431) in view of Jankowski et al. (U.S. Pat. 6,217,722) and Kaiser (U.S. Pat. 4,591,417).

Aviram et al. teach a resistive layer comprised of a multi-component composition including a metal (such as Ti, Ni, Cr, Mo, W, Co, and Sn) and a wide bandgap insulator (such as Al_2O_3, SiO_2, SnO_2 and AlN) where the relative amounts of metal and insulator are chosen to provide a desired resistivity. (Column 4 lines 3-8) Various metals can be mixed with these insulators to provide a usable system. Such metals include Ti, Ni, Cr, Mo, W, Co, Sn, Al, Au, Cu, etc. (Column 5 lines 44-46)

The resistive layer if this invention can be fabricated in many ways, including evaporation and sputtering. (Column 6 lines 3-4) Both dc and rf sputtering can be used. In a first technique, co-sputtering is used, in which two sources (targets) are placed in the vacuum chamber. One target is the metal and the other is wide band gap insulator. (Column 6 lines 34-41) As an alternative to the dual target sputtering system, a single target can be used in which the metal and insulator are mixed in the proportions which are desired in the resistive layer. (Column 6 lines 49-

52) Another alternative to the sputtering technique is one in which the metal is sputtered in the presence of the gaseous atmosphere. (Column 6 lines 59-61)

For example, a metal-insulator composition can be made by evaporation in which the rate of evaporation is varied to provide difference compositional ranges. Still further, the rate of evaporation as well as the pressure of the gaseous environment in the vacuum chamber, to provide additional compositions. By varying the parameters such as rate of evaporation and the gaseous pressure, the relative percentages of metal and insulator can be varied. (Column 7 lines 33-41)

Another way to vary the resistivity of the film is to vary the pressure of the gaseous environment in the evaporation or sputtering chamber. This will affect the relative amounts of metal and insulator in the resistive layer. This parameter (change in gas pressure) can be combined with a change in evaporation rate in order to get even different compositions. For example, in the Al-Al2O3 system, it was found that, at higher rates of evaporation, more oxygen pressure was required in order to obtain higher resistivities. Those of skill in the art will appreciate that this is a logical result, since higher evaporation rates mean that greater amounts of Al atoms are being evaporated or sputtered from the Al source. To obtain larger percentage of the oxide Al2O3, higher oxygen pressures are required. (Column 10 lines 66-68; Column 11 lines 1-12)

The resistive layer is a cermet. (Column 15 lines 1-2) The resistive layer has a resistivity of between about 100 ohms-cms and 1000 ohms-cm. (Column 15 lines 1-3) The resistive layer

has a thickness of between about 0.1 and 2 micrometers. (Column 16 lines 5-7) The resistive layer is between about 500 and about 2000 ohms/sq. (Column 16 lines 31-33)

The differences between Aviram et al. and the present claims is that the use of a magnetron is not discussed and control of power to adjust deposition rate from the metal targets is not discussed.

Jankowski et al. teach rf sputter depositing from a ceramic target using a reactive working gas mixture of Ar and O2. The film resistivity can be discretely selected through control of the target composition and the deposition parameters. (See Abstract) Fig. 3 graphically illustrates resistivity variation with oxygen partial pressure as measured at 10 volts for deposition conditions of a 6 mTorr total working gas pressure and a 6 Watts cm^{-2} applied target power. (Column 4 lines 18-21)

A gas pressure ranging from 2 mTorr to 15 mTorr is typically used to operate the planar magnetron source. A substrate is used with an electrically conducting surface, as for example a metal-coated silicon wafer. (Column 4 lines 56-60)

The rf sputter deposition is carried out using an energy in the range of about 2 to about 20 Watts cm^{-2}. (Column 6 lines 35-37)

The motivation for utilizing a magnetron for sputtering is that it allows for deposition of a resistive film with stable behavior. (Column 2 lines 24-26)

Kaiser et al. teach that a metal and an insulator are alternately deposited on a substrate. The alternate deposition is continued until the desired film thickness of the cermet is obtained. (See Abstract)

The metal volume fraction of cermets can be easily changed by changing, for example, relative power applied to the two targets, whereas in the prior art co-sputtering method, the target composition must be changed each time it is desired to change the metal volume fraction. (Column 2 lines 65-68; Column 3 lines 1-2)

Radio frequency power and monitoring circuits 50 and 51 are coupled to targets 40 and 41, respectively, so that the sputtering process can be adjusted, controlled and monitored. (Column 3 lines 64-67) The relative amount of material deposited on substrate 39 from each target 40, 41, which determines the composition of the cermet, is precisely controlled by the ratio of the powers supplied to each target 40, 41 by the power and monitoring circuits 50 and 51. (Column 4 lines 16-21)

In summary, the metal insulator composition of the cermet is dependent on the relative rates of deposition of the metal and the insulator. (Column 4 lines 32-35)

The choice of the relative power to the Au and silicon dioxide targets determine the metal volume fraction. (Column 5 lines 22-23)

The motivation for controlling the power to control deposition rate is that it allows for control of the composition of the film. (Column 2 lines 65-67)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Aviram et al. by utilizing magnetron sputtering as taught by Jankowski et al. and to have controlled the power to control deposition rate as taught by Kaiser et al. because it allows for depositing a stable film and allows for control of composition of the film.

4. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aviram et al. in view of Jankowski et al. and Kaiser et al. as applied to claim 8 above, and further in view of Hohenstein "Cermet Resistors by Concurrent rf and dc Sputtering" Communications, October 1967.

The differences not yet discussed is utilizing RF and DC sputtering to produce the resistive film.

Hohenstein teach making a thin-film resistor of extremely high resistance by ***dc sputtering*** a metal while concurrently sputtering a ceramic using the ***radio frequency sputtering technique.*** (Page 65) The method involves pumping the system to a pressure of 5 * 10-7 Torr and backfilling with argon to a pressure of 5 * 10-3 Torr. The argon flow is stabilized at 4.7 cm3/min. The plasma is carried by the anode circuit at 45 V and 3 ½ A. The voltage and current for the metal electrode and the ceramic electrode are varied depending on the electronic characteristics desired in the film and the metal used. For the metal electrode, the voltage range was 400 V to 1200 V; current range was from 70 mA to 250 mA. For the Pyrex electrode, the rf power output was from 200 to 600 W. (Page 66) Sheet resistance varied from 7.5 ohm/square to 4 Mohm/square. Specific resistance varied from 10-6 to 2 * 10-1 ohm cm. The temperature coefficient of

resistance varied from about -400 parts per million for a low-resistance film, to about 2000 ppm for the very high resistance films. (Page 66)

The motivation for utilizing combined DC and RF sputtering techniques to produce the resistive film is that it allows for controlling resistance. (Page 66)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized combined DC and RF sputtering techniques to produce resistive films as taught by Hohenstein because it allows for controlling resistance.

5. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aviram et al. in view of Jankowski et al. and Kaiser et al. as applied to claim 8 above, and further in view of Swinehart et al. (U.S. Pat. 5,367,285).

The differences not yet discussed is the use of a oxidized silicon substrate.

Swinehart et al. teach depositing resistive films on a substrate material of any available electrically insulative material. (Column 4 lines 37-39) The range of total gas pressure during deposition can be from 0.066 pascals to 6.6 pascals or higher, and more preferably between about 0.13 pascals to 1.33 pascals. The gas partial pressures do not necessarily need to be controlled directly, but their values are related to the gas flow versus magnetron power. The total pressure should be controlled to maintain a constant gas collision rate as the reactive gas portion is varied to obtain different TCR's. In this regard, the mass flow of argon can be set at a value compatible with the pumping speed available and the desired total pressure. Magnetron power may then be chosen and fixed. The mass flow of the oxygen/nitrogen mixture can then be set at differing

volume percentages of the argon flow to obtain the desired temperature coefficient of resistance. (Column 5 lines 35-49)

If the magnetron power is changed, the flow of the reactive gas must be changed in the same direction. (Column 5 lines 63-65)

The motivation for selecting an insulating substrate such as an oxidized silicon substrate is that it allows a stable substrate. (Column 4 lines 41)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized an oxidized silicon substrate (i.e. an electrically insulating substrate) as taught by Swinehart et al. because it allows for providing a stable substrate for supporting a resistive film.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney McDonald whose telephone number is 703-308-3807. The examiner can normally be reached on M-Th from 8 to 5:30. The examiner can also be reached on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen, can be reached on (703) 308-3322. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9310.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

RODNEY G. MCDONALD
PRIMARY EXAMINER

RM

October 15, 2002